R E M A R K S

Attorney for applicants has attempted, without success to date, to obtain the signatures of the inventors on a Supplemental Declaration. Upon receipt of the Supplemental Declaration by attorney for applicants, attorney for applicants will forward the Supplemental Declaration to the U.S. Patent and Trademark Office.

Claim 7, 8 and 29-31 have been amended to obviate the rejection based on 35 USC 112, ¶2. The amendment to claim 7 corrects a clerical-type error; applicants originally intended for the word "not" to be in claim 7. The amendments to claims 29-31 broaden these claims, which are presumably considered allowable because they were not rejected on art and depend on a claim which has been allowed. The amendment to claim 8 removes the objectionable word "slightly" and replaces it with functional language.

Applicants note the allowance of claims 25-28 and the indication of claims 10-14 and 29-32 as containing allowable subject matter.

Applicants traverse the rejection of claims 1-9, 17, 18 and 22-24 as being obvious as a result of Baldwin et al, WO99/34399 in view of Collins et al, U.S. Patent 6,077,384. (For the Examiner's information, the Baldwin et al reference is essentially equivalent to U.S. Patent 6,280,563.) Claim 1, upon which claims 2-9, 17, 18 and 22-24 depend, patentably distinguishes over the combination of

references by requiring a coil, non-magnetic metal arrangement that is interposed between the coil and a semiconductor member to be arranged for preventing substantial electric field components of an electromagnetic field generated by a coil from being incident on the semiconductor member while enabling substantial electric and magnetic field components from the coil to be incident on the gas for ionizing the gas.

The Examiner appears to rely on the statement on page 15, lines 2-4, of Baldwin et al which indicates that the non-magnetic metal member, formed by copper or aluminum thin film 44, is configured to pass electric and magnetic fields derived from coil 36 to the interior of chamber 12. If this statement is accurate, film 44 also passes the electric field from coil 36 to plate 56, which the Examiner refers to as an electrode. This is because film 44 is interposed between coil 36 and plate 56. If the statement is inaccurate and the electric field from coil 36 does not penetrate film 44, the electric field from coil 36 is not coupled to the plasma. Consequently, the Examiner's statements about elements 44 and 56 of Baldwin et al are inaccurate.

As illustrated in Fig. 2, the non-magnetic metal members 42 include a multiplicity of slots to disrupt eddy currents which would otherwise flow in the non-magnetic metal members. If eddy currents were to flow in film 44, they would substantially prevent inductive coupling of magnetic fields from coil 36 to the plasma in

chamber 12. Of course, the metal, non-magnetic material of film 44 and plate 56, which is typically copper or aluminum, has a very low resistivity on the order of $10^{\text{[illegible]}}$ ohm.centimeters; see enclosed page 487 of Sears et al, *College Physics*, Fifth Edition, Addison-Wesley Publishing Company (1980: Reading, Massachusetts). As such, film 44 and plate 56 are basically equi-potential surfaces between coil 36 and the plasma; see page 7, lines 14 and 15.

In contrast, semiconductor window 110 of Collins et al has a relatively high resistivity of approximately 30 ohm centimeters; see column 18, line 63 and column 19, lines 49-55, which includes the following statement:

> It is preferable to employ a high resistivity silicon (e.g., 30 Ω-cm at room temperature) in the ceiling 110. Otherwise, using, for example, 0.01 Ω-cm resistivity silicon in the ceiling 110 would require reducing the frequency of the RF induction field to the kHz range or below....

Thus, the relatively high resistivity material of Collins et al is entirely different from the high conductivity non-magnetic metal Baldwin et al employs.

The semiconductor material of Collins et al is also incompatible, in use, with the non-magnetic metal structures Baldwin et al employs. Baldwin et al indicates that the non-magnetic metal members are powered, either with AC or DC. The non-magnetic metal members are powered to (1) assist in igniting gas in the chamber prior to the plasma being activated, to assist in

plasma activation (page 8, lines 33-36); (2) assist in depositing material from the powered non-magnetic metal member onto a workpiece in the chamber (page 7, lines 3-20); (3) stabilize the plasma (page 9, line 25 - page 10, line 4); and (4) clean the window (page 9, lines 15-17). All of these uses require the powered electrode to be a metal. Consequently, one skilled in the art would not replace the non-magnetic metal member 44 Baldwin et al discloses with the relatively high resistivity semiconductor window 110 of Collins et al. The nine orders of magnitude difference in resistivity of the non-magnetic metals of Baldwin et al and the semiconductor of Collins et al prevents semiconductor 110 of Baldwin et al from replacing non-magnetic metal film 44 to achieve the Baldwin et al objects.

Applicants also note that the structure which claim 1 defines enables a plasma processing chamber to be operated in two different modes, either in the capacitive mode or in the electromagnetic field mode. The electromagnetic field mode is provided by energizing the coil, while the semiconductor electrode is grounded. The capacitive mode occurs when the coil is de-energized and the semiconductor electrode remains grounded. The capacitive mode occurs as a result of the potential between the semiconductor electrode and the voltage applied to a bottom electrode.

Collins et al proposes a processor to perform the same thing. However, the Collins et al processor employs a semiconductor

material having very specialized characteristics which applicants found to be unnecessary. Hence, the failure by Collins et al to recognize the solution set forth in claim 1 is strong evidence of the unobviousness of this solution.

Based on the foregoing, claim 1 and the claims dependent thereon are patentable over the applied references. Further, some of the dependent claims define features which are not rendered obvious by the combination. For example, claim 4 requires the non-magnetic metal arrangement to include a member that abuts the semiconductor member. Claim 6 and 8 require the non-magnetic metal arrangement to include first and second members respectively abutting and spaced from the semiconductor member. Since the two metal members of Baldwin et al do not abut, the Examiner's position with regard to these claims which define structures to achieve the result claim 1 defines is without merit. While Baldwin et al includes embodiments having spaced non-magnetic metal members, there is no embodiment in which the spaced non-magnetic metal members respectively are abutting and spaced from a further non-magnetic metal member, which the hindsight substitution created by the Examiner's reasoning would require with regard to claim 6.

Claim 7, as amended, distinguishes over the proposed combination by requiring peripheral portions of the semiconductor members to be not outside of the coil interior portion.

The rejection of claims 15 and 16 is incorrect because these

claims depend on claim 1. Koshimizu, U.S. Patent 6,101,970, has no impact on claim 1.

Since generic claim 1 is patentable, consideration of all of claims 1-32 is in order.

In view of the foregoing amendments and remarks, favorable reconsideration and allowance are respectfully requested and deemed in order.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 07-1337 and please credit any excess fees to such deposit

Respectfully submitted,

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MARKED-UP VERSION SHOWING CHANGES

7. (amended) The vacuum plasma processor of claim 3 wherein the dielectric window, semiconductor member and non-magnetic metal arrangement are in a roof structure of the chamber, the chamber having a center portion, the coil having an interior portion that is spaced from the chamber center portion so peripheral portions of the semiconductor member are <u>not</u> outside the coil interior portion, the non-magnetic metal arrangement having peripheral portions spaced from the chamber center portion by approximately the same distance as the semiconductor member peripheral portions.

8. (amended) The vacuum plasma processor of claim 7 wherein the non-magnetic metal arrangement includes first and second members respectively abutting and spaced from the semiconductor member, [the first non-magnetic metal member having a periphery slightly outside the periphery of the semiconductor member,] the first and second non-magnetic metal members having approximately aligned peripheries<u>, each of the first and second non-magnetic metal members having a periphery outside the periphery of the semiconductor member to such an extent that the first and second non-magnetic members do not prevent the electric and magnetic field components from the coil from being incident on the plasma</u>.

29. (amended) The vacuum plasma processor of claim 28 wherein the non-magnetic metal member is adjacent the semiconductor member and the second diameter is [slightly] greater than the third diameter.

30. (amended) The vacuum plasma processor of claim 28 wherein the non-magnetic metal member is adjacent the coil and has a diameter [slightly] less than the interior diameter of the coil innermost turn.

31. (amended) The vacuum plasma processor of claim 28 wherein the non-magnetic metal arrangement includes first and second circular members co-axial with the chamber interior wall, the first circular member being adjacent the semiconductor member and the second diameter is [slightly] greater than the third diameter, the second circular member being adjacent the coil and has a diameter [slightly] less than the interior diameter of the coil innermost turn.

COLLEGE PHYSICS

FIFTH EDITION

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City University of New York

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Professor of Physics
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ADDISON-WESLEY
PUBLISHING COMPANY

Reading, Massachusetts
Menlo Park, California
London · Amsterdam
Don Mills, Ontario · Sydney

This book is in the
ADDISON-WESLEY SERIES IN PHYSICS

Sponsoring editor: Laura Rich Finney
Production editor: Mary Cafarella
Designer: Robert Rose
Illustrator: Oxford Illustrators, Ltd.
Cover design: Ann Scrimgeour

Library of Congress Cataloging in Process Data:

Sears, Francis Weston, 1898–1975
College physics.

Includes index.

1. Physics. I. Zemansky, Mark Waldo, 1900– joint author. II. Young, Hugh D., joint author. III. Title.

QC23.S369 1980 530 79-20729
ISBN 0-201-07681-0

Reprinted with corrections, January 1982

ISBN 0-201-07200-9
CDEFGHIJ-RN-898765432

Table 28-1 Resistivities at room temperature

Substance		ρ, $\Omega \cdot m$	Substance		ρ, $\Omega \cdot m$
Conductors			Semiconductors		
Metals	Silver	1.47×10^{-8}	Pure	Carbon	3.5×10^{-5}
	Copper	1.72×10^{-8}		Germanium	0.60
	Gold	2.44×10^{-8}		Silicon	2300
	Aluminum	2.63×10^{-8}	Insulators		
	Tungsten	5.51×10^{-8}		Amber	5×10^{14}
	Steel	20×10^{-8}		Glass	10^{10}–10^{14}
	Lead	22×10^{-8}		Lucite	$> 10^{13}$
	Mercury	95×10^{-8}		Mica	10^{11}–10^{15}
Alloys	Manganin	44×10^{-8}		Quartz (fused)	75×10^{16}
	Constantan	49×10^{-8}		Sulfur	10^{15}
	Nichrome	100×10^{-8}		Teflon	$> 10^{13}$
				Wood	10^{8}–10^{11}

that good electrical conductors, such as the metals, are also good conductors of heat, while poor electrical conductors, such as ceramic and plastic materials, are also poor thermal conductors.

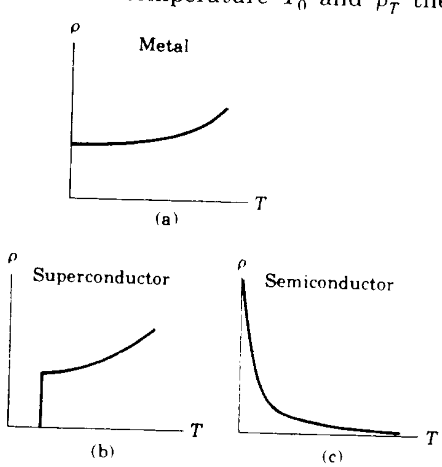
The *semiconductors* form a class intermediate between the metals and the insulators. They are of importance not primarily because of their resistivities, but because of the way in which these are affected by temperature and by small amounts of impurities.

The discovery that ρ is a constant for a metallic conductor at constant temperature was made by G. S. Ohm (1789–1854) and is called *Ohm's law*. A material obeying Ohm's law is called an *ohmic* conductor or a *linear* conductor. If Ohm's law is *not* obeyed, the conductor is called *nonlinear*. Thus Ohm's law, like the ideal gas equation, Hooke's law, and many other relations describing the properties of materials, is an *idealized model* that describes the behavior of certain materials reasonably well but is by no means a general property of all matter.

The resistivity of all *metallic* conductors increases with increasing temperature, as shown in Fig. 28-2a. Over a temperature range that is not too great, the resistivity of a metal can be represented approximately by the equation

$$\rho_T = \rho_0[1 + \alpha(T - T_0)], \tag{28-5}$$

where ρ_0 is the resistivity at a reference temperature T_0 and ρ_T the



28-2 Variation of resistivity with temperature for three conductors: (a) an ordinary metal, (b) a superconducting metal, alloy, or compound, and (c) a semiconductor.